REPORT No.: SZ16060158W03

FCC RF TEST REPORT

APPLICANT	:	Nomura Engineering Co., Ltd.
PRODUCT NAME	:	Radio Module
MODEL NAME	:	TS02FE-F
TRADE NAME	:	N.A
BRAND NAME	:	N.A
FCC ID	:	2AIXL-TS02FE90
STANDARD(S)	:	47 CFR Part 90 Subpart I
ISSUE DATE	:	2016-12-13

SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.

MORLAB GROUP
FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road, Block67, BaoAn District, ShenZhen , GuangDong Province, P. R. China
Tel: 86-755-36698555 Fax: 86-755-36698525
Http://www.morlab.com E-mail: service@morlab.cn

DIRECTORY

Change History		
Issue	Date	Reason for change
1.0	2016-11-23	First edition
2.0	2016-12-06	Deleted the Antennal requirement and receiver spurious emission; Change the test plot for transmitter frequency behavior
3.0	2016-12-13	Update the Emission Mask test data

TEST REPORT DECLARATION

Applicant	Nomura Engineering Co., Ltd.
Applicant Address	1-7-2 Shibuya, Yamato City, Kanagawa, 242-0023 Japan
Manufacturer	Nomura Engineering Co., Ltd.
Manufacturer Address	1-7-2 Shibuya, Yamato City, Kanagawa, 242-0023 Japan
Product Name	Radio Module
Model Name	TS02FE-F
Brand Name	N.A
HW Version	P5-3
SW Version	0040
Test Standards	47 CFR Part 90 Subpart I
Test Date	2016-11-15 to 2016-12-13
Test Result	PASS

Tested by : Zou Jian

Zou Jian

Reviewed by : Qiu Xiaojun

Qiu Xiaojun

Approved by : Peng Huarui

Peng Huarui

1. TECHNICAL INFORMATION

Note: Provide by applicant.

1.1 Applicant Information

Company:	Nomura Engineering Co., Ltd.
Address:	1-7-2 Shibuya, Yamato City, Kanagawa, 242-0023 Japan

1.2 Equipment under Test (EUT) Description

Brand Name:	N.A
Trade Name:	N.A
Model Name:	TS02FE-F
Frequency Range:	The frequency used is 434.05MHz – 434.5375MHz (Channel spacing 12.5KHz);
Modulation Type:	FSK
Antenna Type:	λ/4 antenna
Antenna Gain:	2.14 dBi

Note1: The EUT is a Radio Module and the frequencies allocated for the Radio Module is F(MHz)=434.05+0.0125*(n-1) (1<=n<=40). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 1 (434.05MHz), 20 (434.2875MHz) and 40 (434.5375MHz).

Note2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer..

1.2.1 Identification of all used EUTs

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the following two numerical characters indicate the software version of the test sample.

EUT Identity	Hardware Version	Software Version
01	P5-3	0040

1.3 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 90 Subpar I for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 90 (October 1,2015)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Result
1	90.205	Power and antenna height limits	2016.11.22	**PASS**
2	90.209	Occupied Bandwidth	2016.11.21	**PASS**
3	90.210	Emission Mask	2016.12.13	**PASS**
4	90.213	Frequency Stability	2016.11.22	**PASS**
5	90.214	Transmitter Frequency Behavior	2016.11.21	**PASS**
6	2.1051; 90.210(h)	Transmitter Conducted Spurious Emission	2016.11.21	**PASS**
7	2.1053; 90.210(h)	Transmitter Radiated Spurious Emission	2016.11.23	**PASS**

The test cases were performed according to the method of measurements prescribed in TIA-603-D-2010(JUNE 24, 2010)

1.3.1 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR PART2/15/90 REQUIREMENTS

2.1 Power and antenna height limits

2.1.1 Requirement

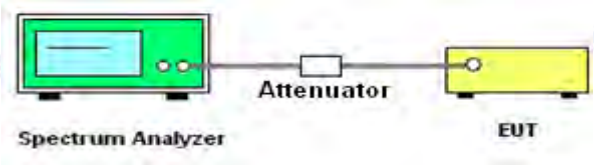
According to FCC section 90.205, The maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2

	Service area radius (km)									
	3	8	13	16	24	32	40	48	64	80
Maximum ERP (w)	2	100	2500	2500	2500	2500	2500	2500	2500	2500
Up to reference HAAT (m)	15	15	15	27	63	125	250	410	950	2700

2.1.2 Test Description

The measured output power was calculated by the reading of the spectrum analyzer and calibration.

A. Test Setup:



The EUT (Equipment under the test) which is powered by the Battery is connected to the Spectrum analyze with an 30dB attenuator; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

B. Equipments List:

Please reference ANNEX A (1.4).

2.1.3 Test Result

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the EUT.

A. Test Verdict:

Modulation Type	Frequency (MHz)	Measured Output Peak Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP (W)
FSK	434.05	8.54	-0.01	8.53	0.0071
	434.2875	8.8		8.79	0.0076
	434.5375	9.06		9.05	0.0080
Note: The EUT Service area radius is 3km, allow the Maximum ERP is 2w, antenna height above average terrain (HAAT) less than 15m					

2.2 Occupied Bandwidth

2.2.1 Requirement

According to FCC section 90.209 Bandwidth limitations:

(a) Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant. In those cases where §2.202 of this chapter does not provide a formula for the computation of necessary bandwidth, the occupied bandwidth, as defined in part 2 of this chapter, may be used in lieu of the necessary bandwidth.

(b) The maximum authorized single channel bandwidth of emission corresponding to the type of emission specified in §90.207 is as follows:

(1) For A1A or A1B emissions, the maximum authorized bandwidth is 0.25 kHz. The maximum authorized bandwidth for type A3E emission is 8 kHz.

(2) For operations below 25 MHz utilizing J3E emission, the bandwidth occupied by the emission shall not exceed 3000 Hz. The assigned frequency will be specified in the authorization. The authorized carrier frequency will be 1400 Hz lower in frequency than the assigned frequency. Only upper sideband emission may be used. In the case of regularly available double sideband radiotelephone channels, an assigned frequency for J3E emissions is available either 1600 Hz below or 1400 Hz above the double sideband radiotelephone assigned frequency.

(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.

(4) Where a frequency is assigned exclusively to a single licensee, more than a single emission may be used within the authorized bandwidth. In such cases, the frequency stability requirements of §90.213 must be met for each emission.

(5) Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table.

Standard Channel Spacing/Bandwidth

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25[2]	20	20
25-50	20	20
72-76	[1]17.5	[1,3]/20/11.25/6
150-174	6.25	20/11.25/6
216-220[5]	5	4
220-222	[1]16.25	[1,3]/20/11.25/6
406-512[2]	12.5	20
806-809/851-854	25	20
809-824/854-869	12.5	13.6
896-901/935-940		
902-928[4]	25	20
929-930	12.5	12.5
1427-1432[5]		
[3]2450-2483.5[2]		
Above 2500[2]		

[1]For stations authorized on or after August 18, 1995.

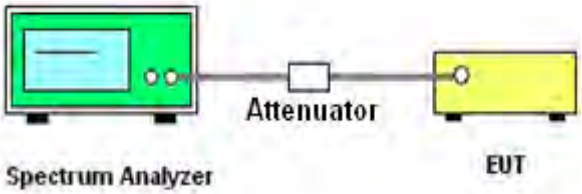
[2]Bandwidths for radiolocation stations in the 420-450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis.

[3]Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of §90.203(j)(3).

[4]The maximum authorized bandwidth shall be 12 MHz for non-multilateration LMS operations in the band 909.75-921.75 MHz and 2 MHz in the band 902.00-904.00 MHz. The maximum authorized bandwidth for multilateration LMS operations shall be 5.75 MHz in the 904.00-909.75 MHz band; 2 MHz in the 919.75-921.75 MHz band; 5.75 MHz in the 921.75-927.25 MHz band and its associated 927.25-927.50 MHz narrowband forward link; and 8.00 MHz if the 919.75-921.75 MHz and 921.75-927.25 MHz bands and their associated 927.25-927.50 MHz and 927.50-927.75 MHz narrowband forward links are aggregated.

2.2.2 Test Description

A. Test Set:



The EUT (Equipment under the test) which is powered by the Battery is connected to the Spectrum analyze with an 30dB attenuator; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

Set the m spectrum analyzer's Center Frequency = fundamental frequency; RBW= 1 kHz; VBW= 3 kHz; Span= 30 kHz; Detector=peak; Sweep time=AUTO; Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth

B. Equipments List:

Please reference ANNEX A(1.4).

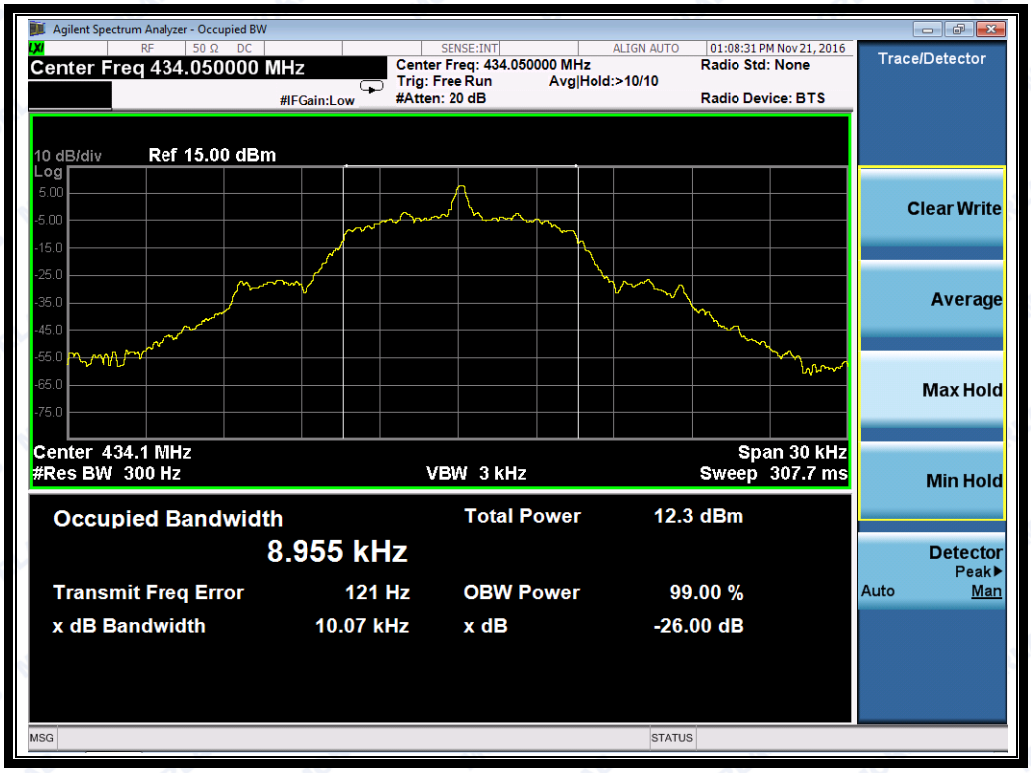
2.2.3 Test Result

The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the EUT.

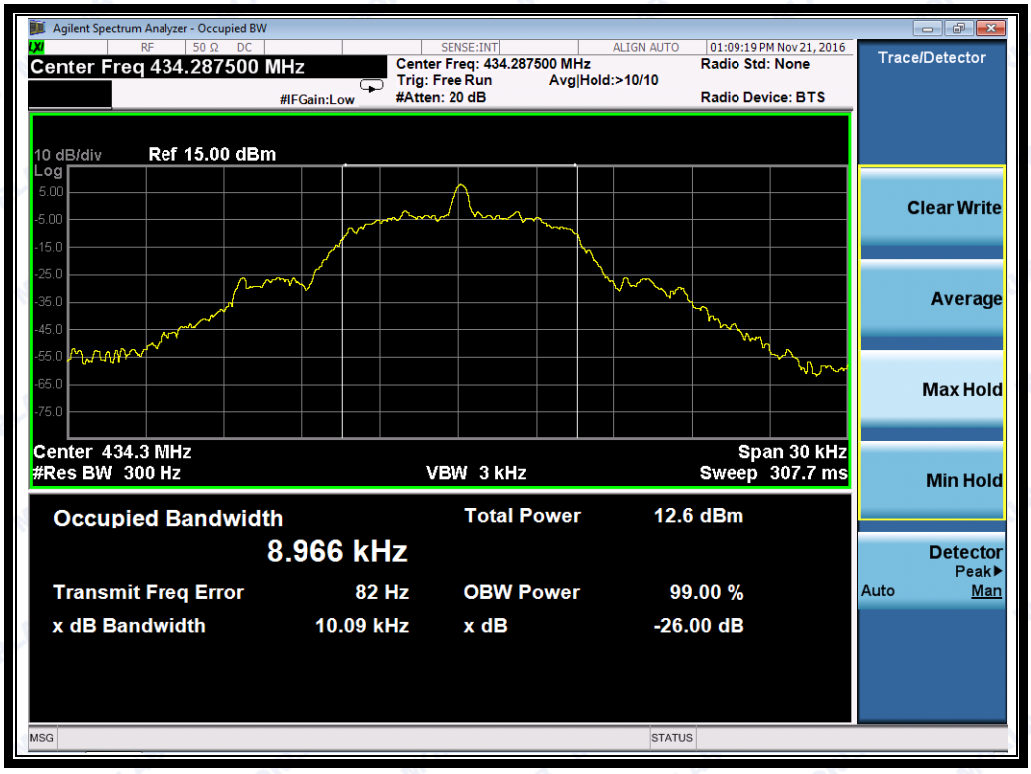
A. Test Verdict:

Modulation Type	Frequency (MHz)	99% Bandwidth (KHz)	26 Bandwidth (KHz)	Refer to Plot	Limits(kHz)	Result
FSK	434.05	8.96	10.07	Plot A1	≤11.25	PASS
	434.2875	8.97	10.09	Plot B1	≤11.25	PASS
	434.5375	9.03	10.08	Plot C1	≤11.25	PASS

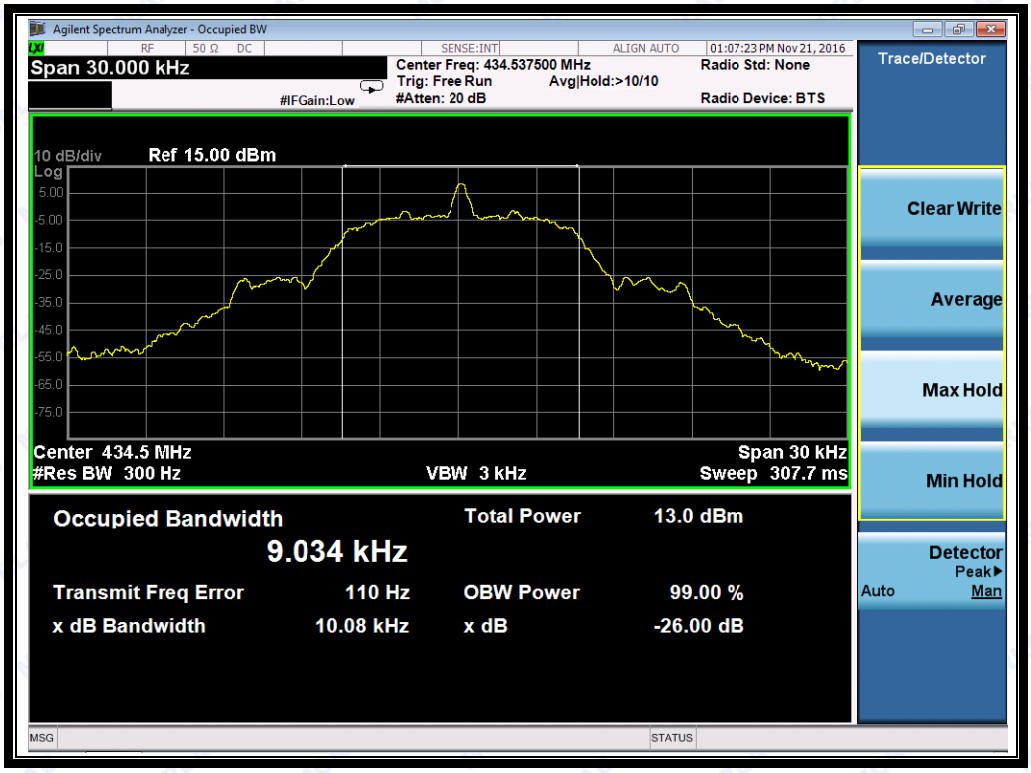
B. Test Plots:



(Plot A1: FSK 434.05MHz)



(Plot B1: FSK 434.2875 MHz)



(Plot C1: FSK 434.5375MHz)

2.3 Emission Mask

2.3.1 Requirement

According to FCC section 90.210, (d) Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

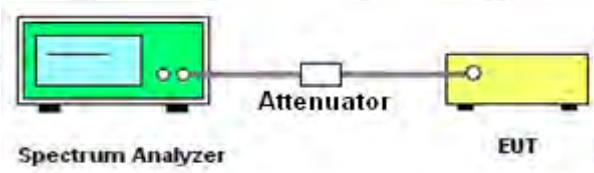
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd−2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

2.3.2 Test Description

A. Test Set:



The EUT (Equipment under the test) which is powered by the Battery, it is connected to the Spectrum analyze with an 30dB attenuator; the path loss as the factor is calibrated to correct the reading for all test result in Spectrum analyzer. Make the EUT into the maximum power emission state :(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.(2) On any frequency removed from the center of the authorized bandwidth by a

displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd−2.88 kHz) dB.(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100Hz. VBW=300Hz; Span=50KHz; Sweep points=2001; Sweep time=AUTO; Detector: Peak; Trace type: Trace average.

B. Equipments List:

Please reference ANNEX A (1.4).

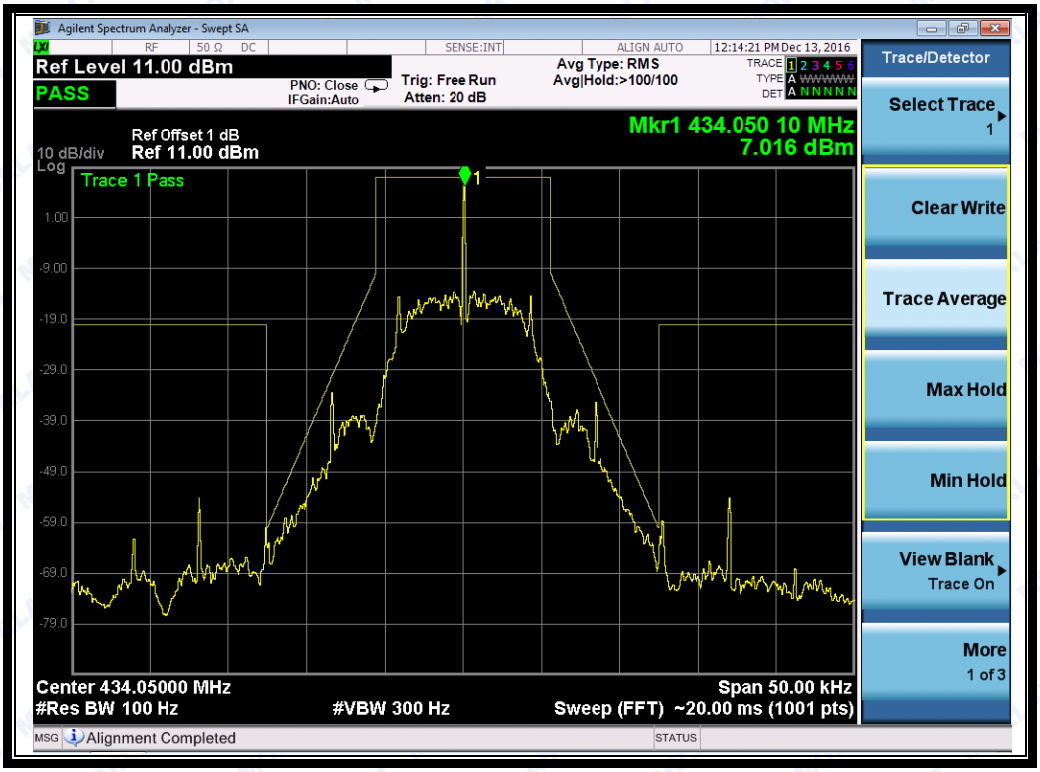
2.3.3 Test Result

The lowest, middle and highest channels are tested to verify the Emission Mask.

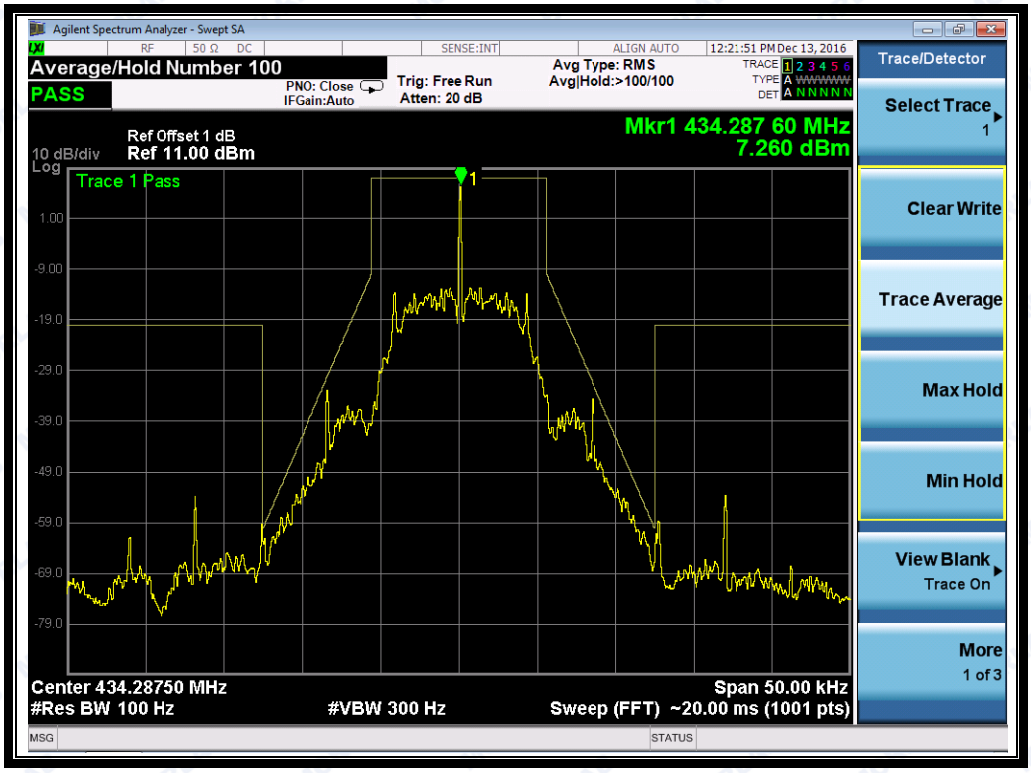
A. Test Verdict:

Channel	Refer to Plot	Verdict
434.05MHz	Plot A4	**Pass**
434.2875MHz	Plot B4	**Pass**
434.5375MHz	Plot C4	**Pass**

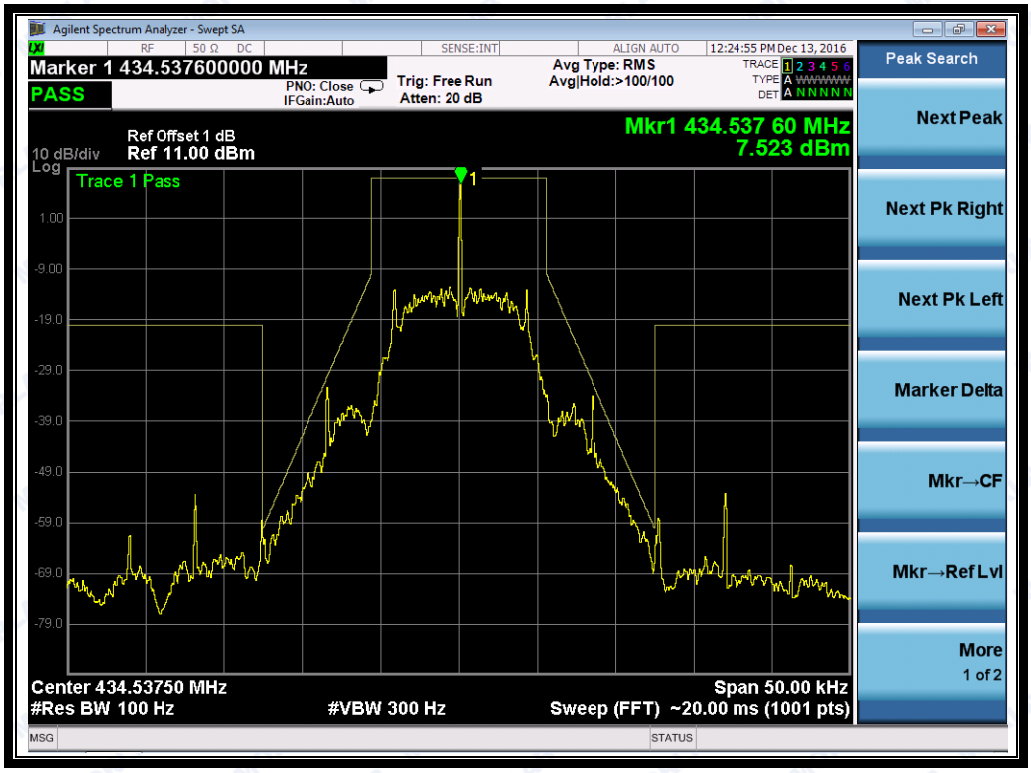
B. Test Plots:



(Plot A4: FSK 434.05MHz)



(Plot B4: FSK 434.2875MHz)



(Plot C4: FSK 434.5375MHz)

2.4 Frequency Stability

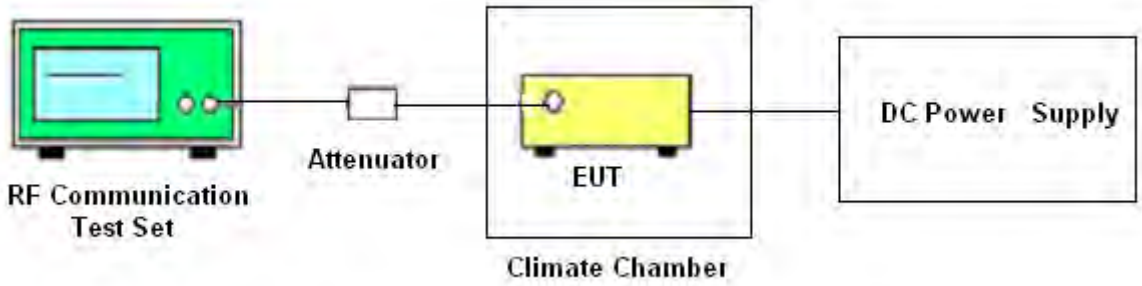
2.4.1 Requirement

According to FCC section 2.1055, the frequency stability shall be measured with variation of ambient temperature from -30℃ to +50℃ centigrade, for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture. Vary primary supply voltage from 85 to 115 percent of the nominal value.

According to FCC section 90.213, In the 421–512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm

2.4.2 Test Description

A. Test Set:



The EUT was set in the climate chamber and powered by the DC power supply, It is connected to the RF Communication Test Set with an 30dB attenuator; the path loss as the factor is calibrated to correct the reading for all test result.

After temperature stabilization for approximately 20 minutes, the lower, the middle and the highest frequency for was measured by the RF Communication Test Set and recorded, For Frequency stability Vs. Voltage the EUT was connected to a DC power supply and the voltage was adjusted in the required ranges.

B. Equipments List:

Please reference ANNEX A (1.4).

2.4.3 Test Result

A. Test Verdict:

DC Voltage (V)	Frequency （MHz）	Temperature (℃)	Frequency error（Hz）	Measure (ppm)	Limit (ppm)	Result
3.0	434.05	-30	337	0.78	2.5	Pass
		-20	345	0.79		Pass
		-10	347	0.80		Pass
		0	339	0.78		Pass
		10	340	0.78		Pass
		20	349	0.80		Pass
		30	352	0.81		Pass
		40	361	0.83		Pass
		50	358	0.82		Pass
3.0	434.2875	-30	366	0.84	2.5	Pass
		-20	358	0.82		Pass
		-10	364	0.84		Pass
		0	359	0.83		Pass
		10	352	0.81		Pass
		20	374	0.86		Pass
		30	371	0.85		Pass
		40	382	0.88		Pass
		50	389	0.90		Pass
3.0	434.5375	-30	336	0.77	2.5	Pass
		-20	342	0.79		Pass
		-10	331	0.76		Pass
		0	348	0.80		Pass
		10	353	0.81		Pass
		20	361	0.83		Pass
		30	376	0.87		Pass
		40	368	0.85		Pass
		50	377	0.87		Pass
2.4	434.05	20	353	0.81	2.5	Pass
3.6		20	345	0.79		Pass
2.4	434.2875	20	371	0.85	2.5	Pass
3.6		20	368	0.85		Pass
2.4	434.5375	20	363	0.84	2.5	Pass
3.6		20	366	0.84		Pass

2.5 Transmitter Frequency Behavior

2.5.1 Requirement

According to FCC section 90.214:

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals[1] [2]	Maximum frequency difference[3]	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1[4]	±12.5 kHz	5.0 ms	10.0 ms
t_2	±6.25 kHz	20.0 ms	25.0 ms
t_3[4]	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1[4]	±6.25 kHz	5.0 ms	10.0 ms
t_2	±3.125 kHz	20.0 ms	25.0 ms
t_3[4]	±6.25 kHz	5.0 ms	10.0 ms

[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on}.

t_2 is the time period immediately following t_1.

t_3 is the time period from the instant when the transmitter is turned off until t_{off}.

t_{off} is the instant when the 1 kHz test signal starts to rise.

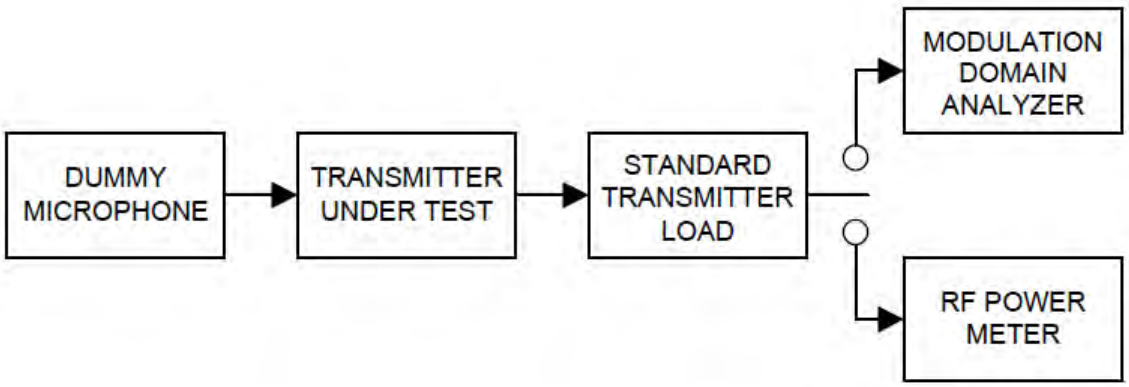
[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.

[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.

[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

2.5.2 Test Description

A. Test Setup



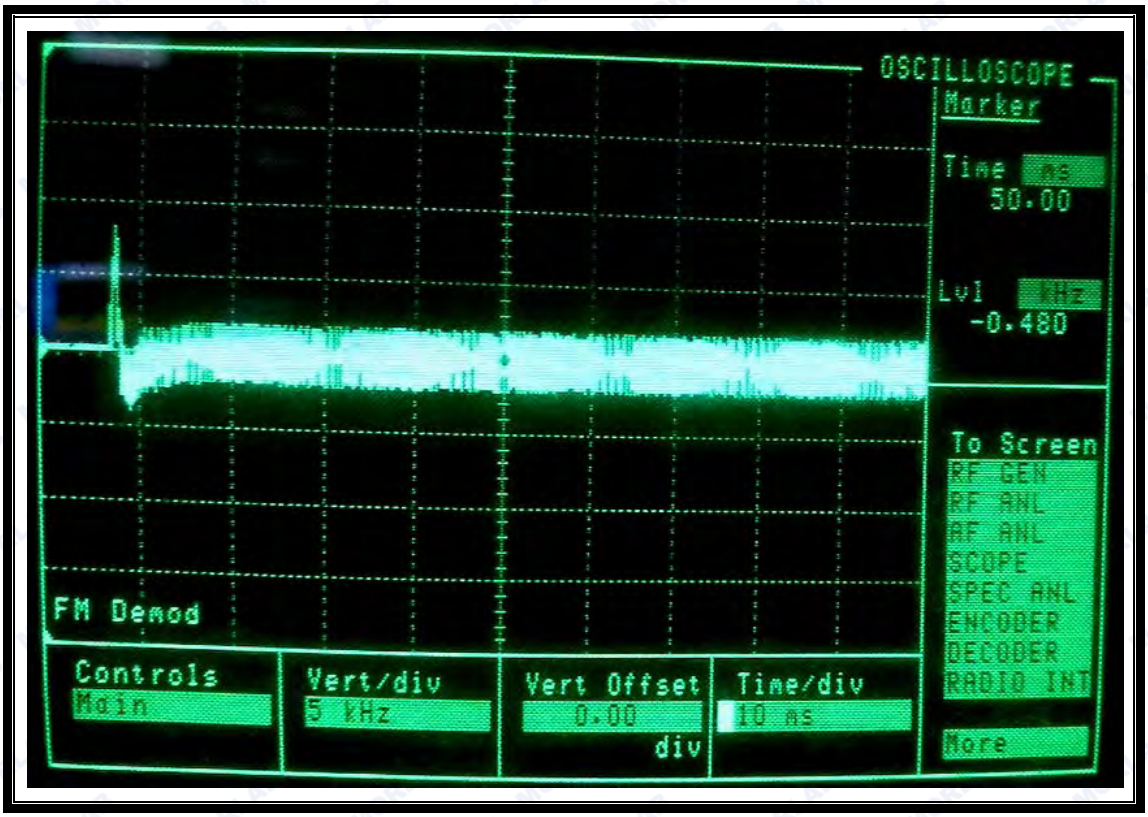
a) Connect the equipment as illustrated.
b) Connect the output of the standard transmitter load to the RF power meter. Supply sufficient attenuation via the RF attenuator to provide a level that is approximately 40 dB below the maximum allowable input to the modulation domain analyzer.
c) Unkey the transmitter.
d) Disconnect the RF power meter and connect the modulation domain analyzer in its place. Set the envelope trigger of the modulation domain analyzer to the minimum level that will trigger when the transmitter is keyed.
e) Reduce the attenuation of the RF attenuator so that the input to the to the modulation domain analyzer is increased by 30 dB when the transmitter is keyed.
f) Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a single-shot turn-on of the transmitter signal.
g) Adjust the display of the modulation domain analyzer for proper viewing of the transmitter transient behavior. Set the time base reference to the left for observing the transmitter turn-on transient.
h) Key the transmitter.
i) Observe the stored display of the modulation domain analyzer. The signal trace shall be maintained within the allowable limits during the periods t1 and t2, and shall also remain within limits following t2.
j) Adjust the modulation domain analyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transient of the transmitter signal.
k) Adjust the display of the modulation domain analyzer for proper viewing of the transmitter transient behavior. Set the time base reference to the right for observing the transmitter turn-off transient.
l) Unkey the transmitter.
m) Observe the stored display of the modulation domain analyzer. The signal trace shall be maintained within the allowable limits during the period t3.

B. Equipments List:

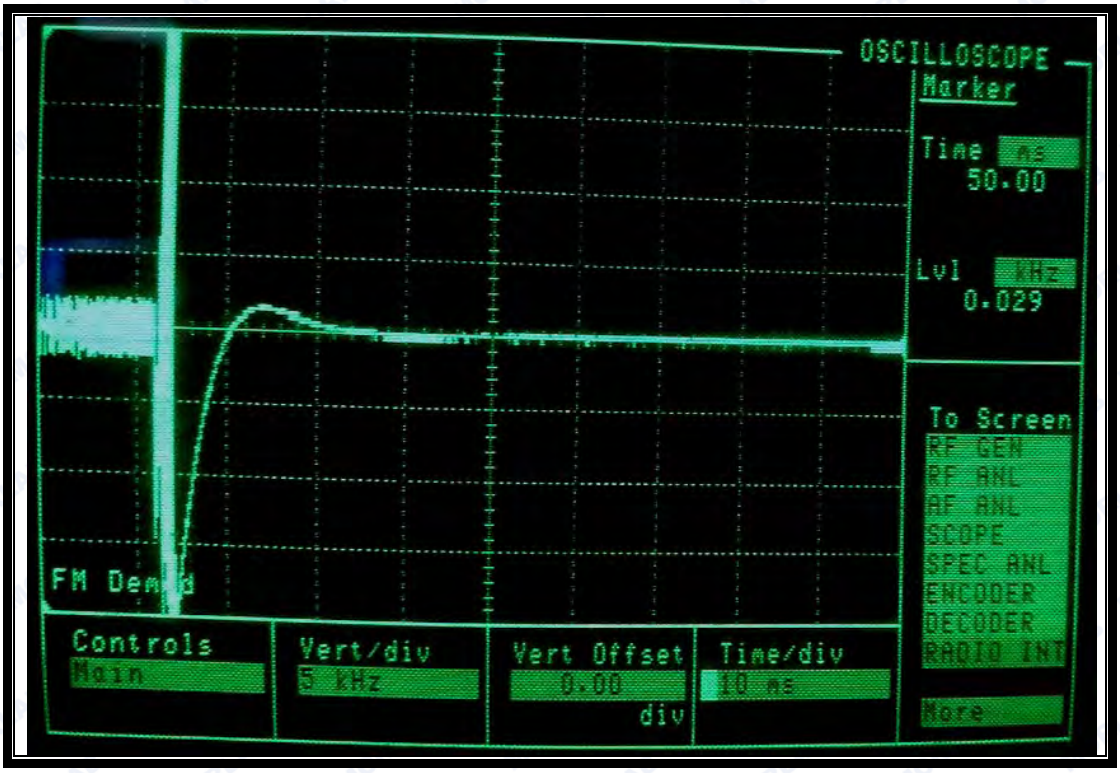
Please reference ANNEX A(1.4).

2.5.3 Test Result

Frequency	Transmitter status	Reference Plot	Result
434.2875	Off-On	Plot A5	Pass
434.2875	On-Off	Plot B5	Pass



（Plot A5：Transmitter Frequency Behavior @ Frequency：434.2875MHz Off-On）



（Plot B5：Transmitter Frequency Behavior @ Frequency：434.2875MHz On-Off）

2.6 Transmitter Conducted Spurious Emission

2.6.1 Requirement

According to FCC section 2.1051, The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

According to FCC section 90.210, (d) Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

Radiated spurious emissions in dB = 50 + 10 log10 (power out in Watts)or an equivalent absolute level of -20 dBm (10 μW)

2.6.2 Test Description

A. Test Set:

The EUT was set in the climate chamber and powered by the DC power supply, It is connected to the Spectrum analyzer with an 30dB attenuator; the path loss as the factor is calibrated to correct the reading for all test result.

For measurements at frequencies below 1 GHz, the spectrum analyzer resolution bandwidth was set to 100kHz. For measurements at frequencies above 1 GHz, the spectrum analyzer resolution bandwidth was set to 1 MHz. Average detector is used for these measurements.

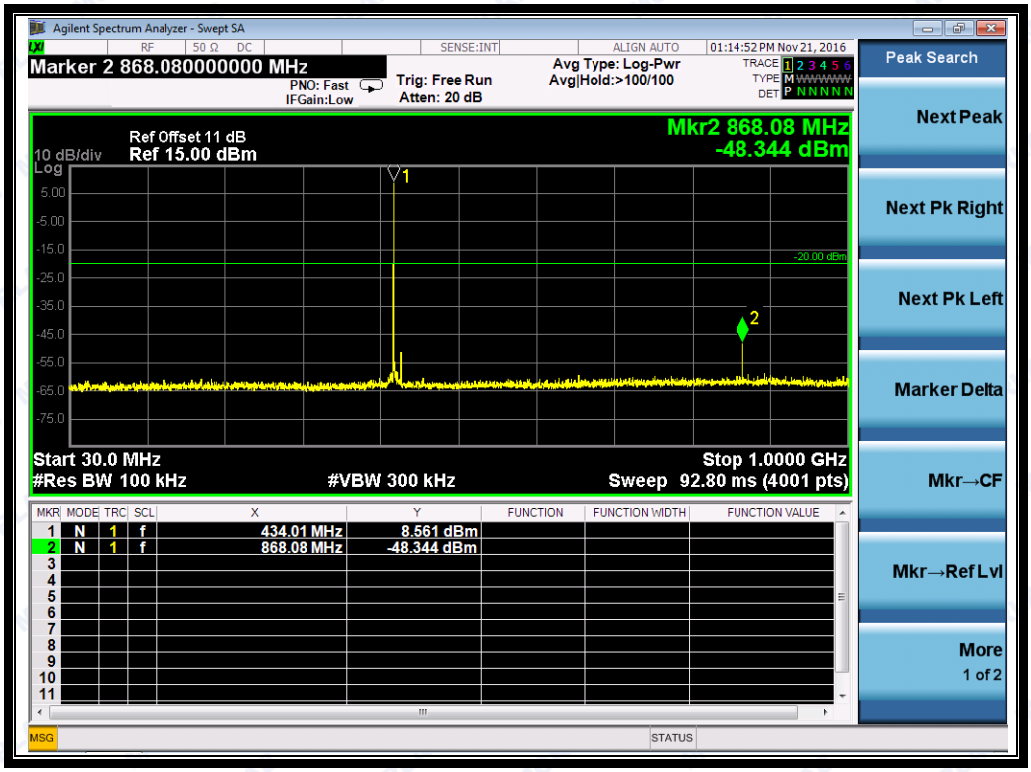
B. Equipments List:

Please reference ANNEX A (1.4).

2.6.3 Test Result

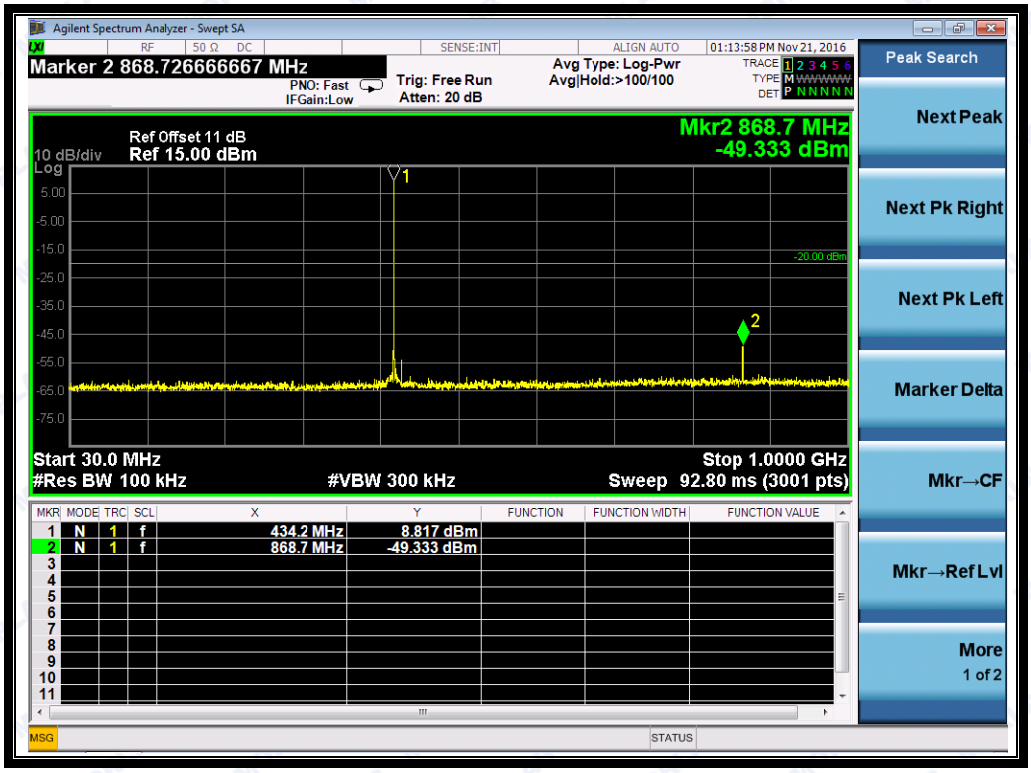
During the test, the EUT operating at the highest transmit power mode . The lowest, middle and highest channels are selected to perform testing to record the 99%and -26 dB bandwidth of the EUT. The following is the worst test results.

Modulation Type	Frequency (MHz)	Refer to Plot	Verdict
FSK	434.05	Plot A7	PASS
	434.2875	Plot B7	PASS
	434.5375	Plot C7	PASS

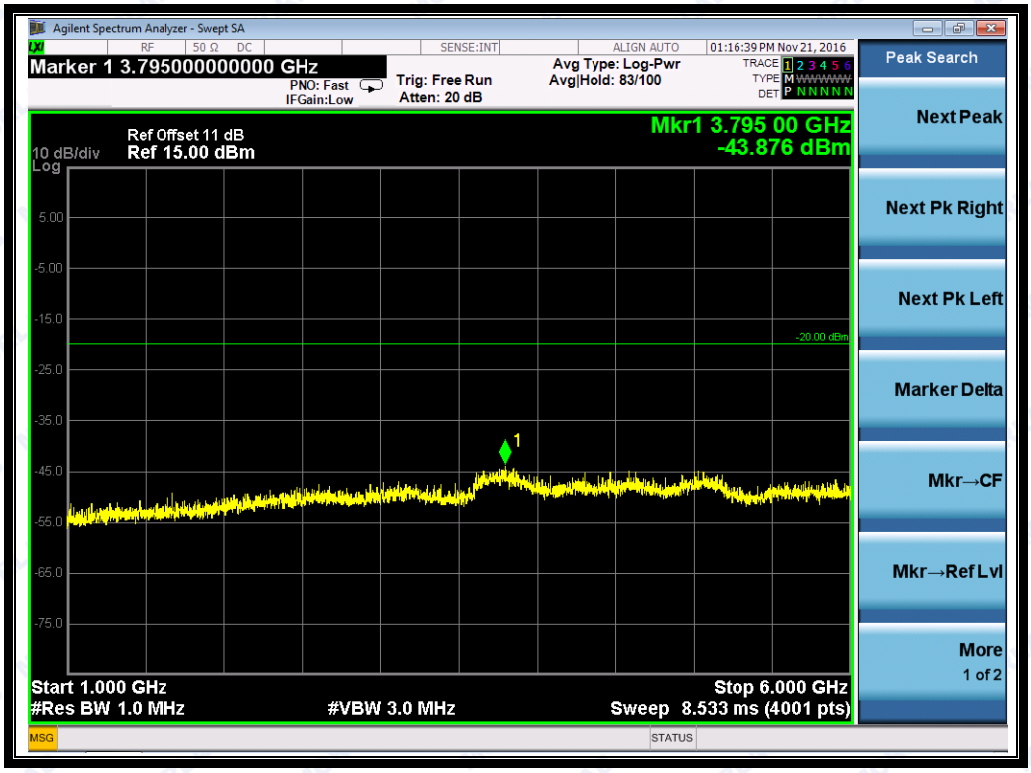


(Plot A7: FSK 434.05MHz 30MHz to 1GHz)

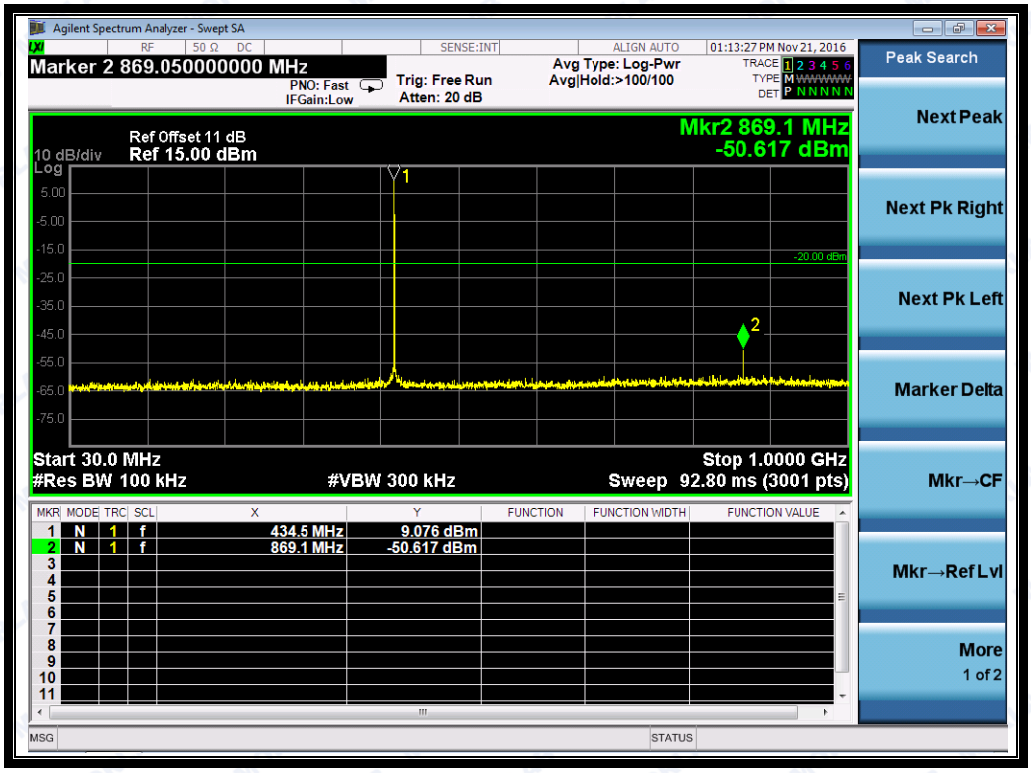
(Plot A7: FSK 434.05MHz 1GHz to 6GHz)



(Plot B7: FSK 434.2875MHz, 30MHz to 1GHz)



(Plot B7: FSK 434.2875MHz, 1GHz to 6GHz)



(Plot C7: FSK 434.5375MHz, 30MHz to 1GHz)

(Plot C7: FSK 434.5375MHz, 1GHz to 6GHz)

2.7 Transmitter Radiated Spurious Emission

2.7.1 Requirement

According to FCC section 2.1051 & 90.210,

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half wave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

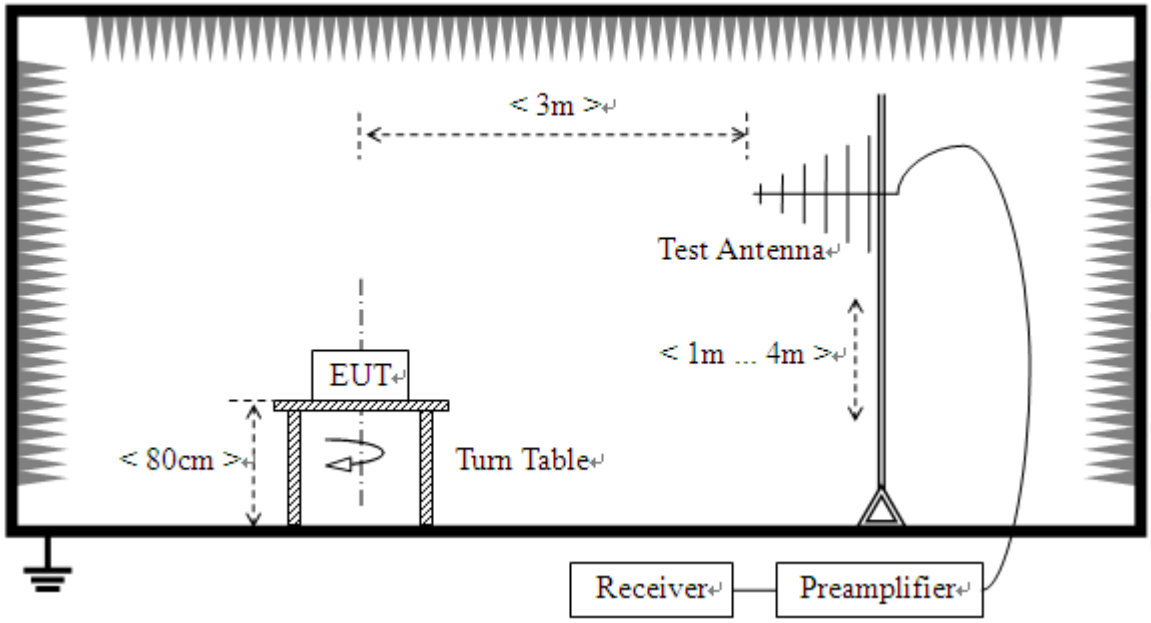
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

Radiated spurious emissions in dB = 50 + 10 log10 (power out in Watts)or an equivalent absolute level of -20 dBm (10 μW)

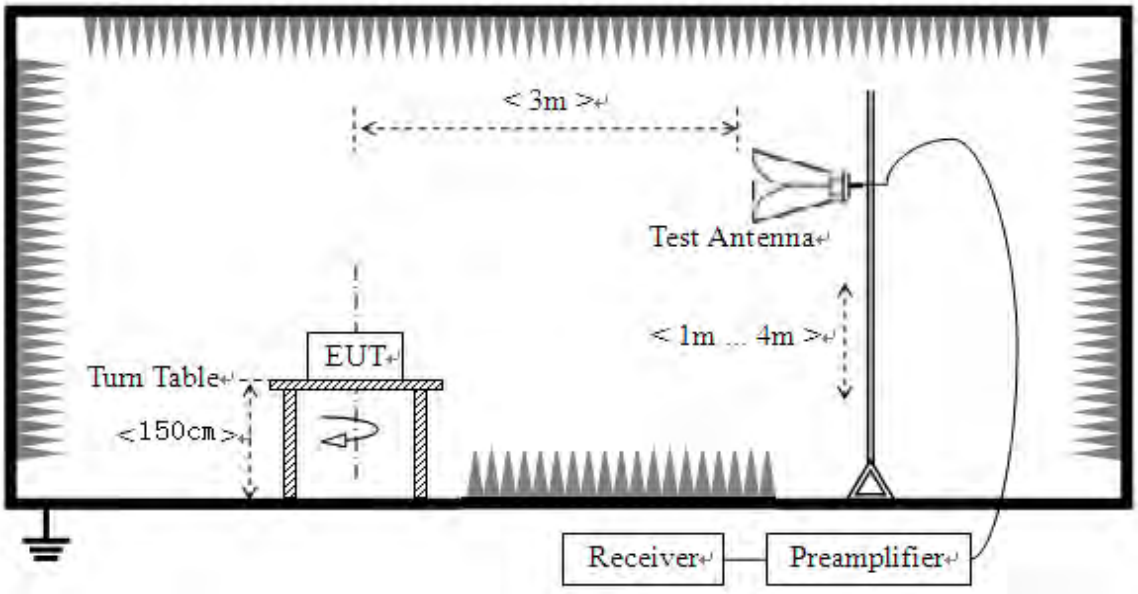
2.7.2 Test Description

A. Test Setup:

1) For radiated emissions from 30MHz to1GHz



2) For radiated emissions above 1GHz



For radiated emissions below or equal to 1GHz,The EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI/TIA-603-D 2010.

The EUT is located in a 3m Semi-Anechoic Chamber and make it in the maximum emission state. The antenna factors, cable loss and so on of the site as factors are calculated to correct the

reading.

For the Test Antenna:

(a) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.
(b) For each spurious frequency, raise and lower the test antenna from 1 m to 4m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

C. Equipments List:

Please reference ANNEX A (1.4).

2.7.3 Test Result

During the test, the EUT operating at the highest transmit power mode . The following is the worst test results.

FSK Mode:

Plots for Channel = 434.05MHz

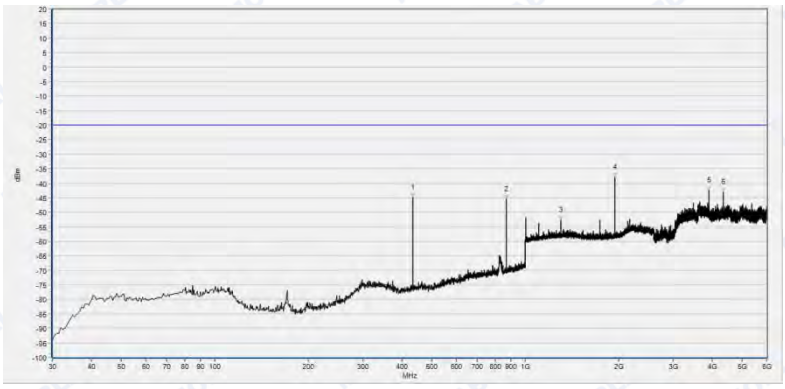
Num	Freq(MHz)	PK	limit PK	Degree	Antenna	Verdict
1	434.207	-38.14	-20.00	50.8	H	PASS
2	868.014	-48.10	-20.00	116.3	H	PASS
3	1736.779	-50.80	-20.00	95.5	H	PASS
4	3473.295	-41.23	-20.00	155.5	H	PASS
5	3906.541	-41.88	-20.00	232.6	H	PASS
6	4341.148	-41.08	-20.00	184.4	H	PASS

(30MHz to5GHz, Antenna Horizontal, channel 434.05MHz)

Num	Freq(MHz)	PK	limit PK	Degree	Antenna	Verdict
1	434.207	-42.00	-20.00	129.6	V	PASS
2	868.014	-46.41	-20.00	166.4	V	PASS
3	1267.289	-47.38	-20.00	165.8	V	PASS
4	2170.524	-51.63	-20.00	293.0	V	PASS
5	3906.541	-45.04	-20.00	310.1	V	PASS
6	4341.148	-42.40	-20.00	319.8	V	PASS

(30MHz to 5GHz, Antenna Vertical, channel 434.05MHz)

Plot for Channel = 434.2875MHz



Num	Freq(MHz)	PK	limit PK	Degree	Antenna	Verdict
1	434.207	-44.80	-20.00	128.9	H	PASS
2	868.499	-45.49	-20.00	65.9	H	PASS
3	1303.034	-52.56	-20.00	333.1	H	PASS
4	1942.714	-37.81	-20.00	351.4	H	PASS
5	3909.262	-42.44	-20.00	331.1	H	PASS
6	4343.189	-43.04	-20.00	311.6	H	PASS

(30MHz to 5GHz, Antenna Horizontal, channel 434.2875MHz)

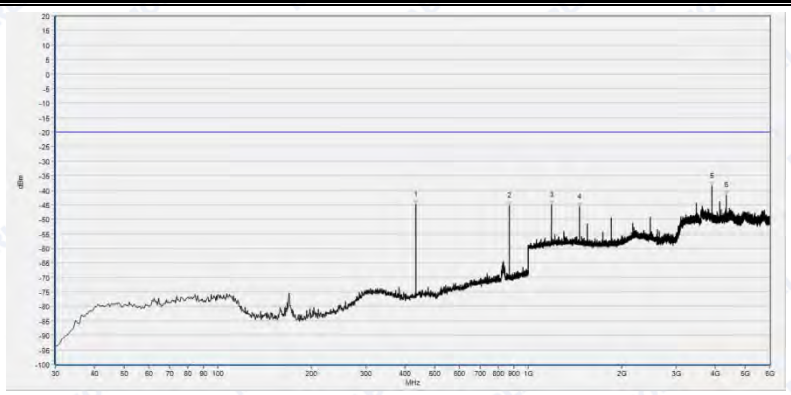
Num	Freq(MHz)	PK	limit PK	Degree	Antenna	Verdict
1	434.207	-45.09	-20.00	146.8	V	PASS
2	868.499	-45.04	-20.00	355.9	V	PASS
3	1112.571	-44.37	-20.00	227.2	V	PASS
4	1795.465	-43.78	-20.00	233.3	V	PASS
5	3908.582	-41.85	-20.00	192.1	V	PASS
6	4343.189	-43.20	-20.00	153.5	V	PASS

(30MHz to 5GHz, Antenna Vertical, channel 434.2875MHz)

Plot for Channel = 434.5375MHz

Num	Freq(MHz)	PK	limit PK	Degree	Antenna	Verdict
1	434.692	-45.15	-20.00	135.3	H	PASS
2	868.984	-44.21	-20.00	85.1	H	PASS
3	1311.037	-44.88	-20.00	197.8	H	PASS
4	2180.660	-46.25	-20.00	184.7	H	PASS
5	3476.695	-44.55	-20.00	49.3	H	PASS
6	3911.302	-40.77	-20.00	49.3	H	PASS

(30MHz to 5GHz, Antenna Horizontal, channel 434.5375MHz)



Num	Freq(MHz)	PK	limit PK	Degree	Antenna	Verdict
1	434.692	-44.77	-20.00	142.7	V	PASS
2	868.984	-45.30	-20.00	353.3	V	PASS
3	1187.262	-45.00	-20.00	194.3	V	PASS
4	1461.487	-45.79	-20.00	206.6	V	PASS
5	3911.302	-38.51	-20.00	87.9	V	PASS
6	4345.909	-41.74	-20.00	167.4	V	PASS

(30MHz to 5GHz, Antenna Vertical, channel 434.5375MHz)

ANNEX A GENERAL INFORMATION

1.1 Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

1.2 Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

1.3 Facilities and Accreditations

Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572.

All measurement facilities used to collect the measurement data are located at FL.1, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10 2013 and CISPR Publication 22; the FCC registration number is 695796.

1.4 Maximum measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Measurements	**Frequency**	**Uncertainty**
Conducted emissions	9KHz~30MHz	2.44dB
Radiated emissions	9KHz~30MHz	2.44dB
	30MHz~200MHz	2.93dB
	200MHz~1000MHz	2.95dB
	1GHz~18GHz	2.26dB
	18GHz~40GHz	1.94dB

This uncertainty represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

1.5 Test Equipments Utilized

1.5.1 Conducted Test Equipments

Conducted Test Equipment						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal. Due**
1	RF Communication Test Set	3822A02388	8920B	HP	2016.4.28	2017.4.27
2	USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2016.03.02	2017.03.01
3	EXA Signal Analyzer	MY53470838	N9010A	Agilent	2016.08.25	2017.08.24
4	RF cable	CB01	RF01	Morlab	N/A	N/A
5	Attenuator	(n.a.)	10dB	Resnet	N/A	N/A
6	SMA connector Note	CN01	RF03	HUBER-SUHNER	N/A	N/A
Note：The SMA antenna connector is soldered on the PCB board in order to perform conducted tests and this SMA antenna connector is listed in the equipment list.						

1.5.2 Radiated Test Equipments

Radiated Test Equipments						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal.Due Date**
1	System Simulator	GB45360846	8960-E5515C	Agilent	2016.03.02	2017.03.01
2	Receiver	MY54130016	N9038A	Agilent	2016.03.02	2017.03.01
3	Test Antenna - Bi-Log	N/A	VULB9163	Schwarzbeck	2016.03.02	2017.03.01
4	Test Antenna - Horn	9170C-531	BBHA9170	Schwarzbeck	2016.03.02	2017.03.01
5	Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2016.03.02	2017.03.01
6	Test Antenna - Horn	71688	BBHA 9120D	Schwarzbeck	2016.03.02	2017.03.01
7	Coaxial cable(N male)	CB02	EMC02	Morlab	N/A	N/A
8	Coaxial cable(N male)	CB03	EMC03	Morlab	N/A	N/A
9	1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde&Schwarz	2016.03.02	2017.03.01
10	18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde&Schwarz	2016.03.02	2017.03.01

1.5.3 Climate Chamber

Climate Chamber						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Climate Chamber	2004012	HL4003T	Yinhe	2016.03.02	2017.03.01

1.5.4 Vibration Table

Vibration Table						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Vibration Table	N/A	ACT2000-S015L	CMI-COM	2016.03.02	2017.03.01

1.5.5 Anechoic Chamber

Anechoic Chamber						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Anechoic Chamber	N/A	9m*6m*6m	Changning	2016.03.02	2017.03.01

1.5.6 Auxiliary Test Equipment

Auxiliary Test Equipment						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Computer	N.A	PU500C	Asus	N.A	N.A

******* END OF REPORT *******